# Complete Summary

## GUIDELINE TITLE

Heart failure in adults.

## BIBLIOGRAPHIC SOURCE(S)

Institute for Clinical Systems Improvement (ICSI). Heart failure in adults. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2006 Aug. 116 p. [204 references]

## GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Heart failure in adults. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2005 Jun. 111 p.

## ** REGULATORY ALERT **

## FDA WARNING/REGULATORY ALERT

Note from the National Guideline Clearinghouse: This guideline references a drug(s)/intervention(s) for which important revised regulatory and/or warning information has been released.

- August 16, 2007, Coumadin (Warfarin): Updates to the labeling for Coumadin to include pharmacogenomics information to explain that people's genetic makeup may influence how they respond to the drug.
- June 8, 2007, Troponin-I Immunoassay: Class I Recall of all lots of the Architect Stat Troponin-I Immunoassay. The assay may report falsely elevated or falsely decreased results at and near a low level, which may impact patient treatment.
- October 6, 2006, Coumadin (warfarin sodium): Revisions to the labeling for Coumadin to include a new patient Medication Guide as well as a reorganization and highlighting of the current safety information to better inform providers and patients.
- July 18, 2005, Natrecor (nesiritide): Due to recent questions raised about worsened renal function and mortality, recommendations were made on the appropriate use of the drug and on utilizing educational campaigns for clinicians.
- May 19, 2005, Natrecor (nesiritide): Revisions to the ADVERSE REACTIONS/Effect on Mortality section of the prescribing information for patients with acutely decompensated congestive heart failure.

## COMPLETE SUMMARY CONTENT



## SCOPE

### DISEASE/CONDITION(S)

- Heart failure (HF)
- Acute pulmonary edema

### GUIDELINE CATEGORY

Counseling
Diagnosis
Evaluation
Management
Risk Assessment
Treatment

### CLINICAL SPECIALTY

Cardiology
Emergency Medicine
Family Practice
Geriatrics
Internal Medicine

### INTENDED USERS

Advanced Practice Nurses
Allied Health Personnel
Health Care Providers
Health Plans
Hospitals
Managed Care Organizations
Nurses
Physician Assistants
Physicians

## GUIDELINE OBJECTIVE(S)

- To decrease the re-admission rate within 30 days of discharge following hospitalization for heart failure.
- To optimize the pharmacologic treatment of adult patients with heart failure
- To improve the use of diagnostic testing in order to identify and then appropriately treat adult patients with heart failure.
- To improve care of adult heart failure patients by assuring comprehensive patient education and follow-up care

## TARGET POPULATION

Adult patients age 18 and older with suspected heart failure and heart failure requiring hospitalization

## INTERVENTIONS AND PRACTICES CONSIDERED

### Diagnosis/Evaluation

1. Initial evaluation, including history, cardiac risk factors, symptoms, lifestyle issues, and physical examination
2. Laboratory evaluation, including
    - Initial evaluation: complete blood count (CBC), prothrombin time/international normalized ratio (PT/INR), electrolytes, renal function (blood urea nitrogen [BUN], creatinine [Cr]), liver function (aspartate transaminase [AST], alanine transaminase [ALT], alkaline phosphatase, bilirubin, T Prot, albumin), urinalysis, sensitive thyroid-stimulating hormone (sTSH)
    - Inpatient/Emergency Department evaluation: arterial blood gases, tests for myocardial injury (troponin, creatine kinase (CK)/creatine kinase muscle brain (MB) band (CKMB), brain natriuretic peptide (BNP)
    - Evaluation for other causes: ferritin/iron/total iron-binding capacity (TIBC)/macrocytic anemias; lipid profile; blood culture if endocarditis suspected; Lyme serology (if suspect bradycardia/heart block); connective tissue disease work up; human immunodeficiency virus (HIV)
3. Assessment of left ventricular functioning by echocardiography or radionuclide ventriculography
4. Electrocardiogram
5. Chest radiograph
6. Ischemia evaluation (stress test, angiography) in selected patients
7. Assessment for causative and precipitating factors of heart failure
8. Assessment for signs and symptoms requiring emergent management or hospitalization

### Treatment/Management

1. Hospitalization if indicated
2. Pharmacologic management including
    - Beta blockers
    - Angiotensin-converting enzyme (ACE) inhibitors

- Angiotensin II receptor blockers (ARBs)
- Thiazide and loop diuretics
- Aldosterone blocking agents
- Digoxin
- Other vasodilators, such as intravenous nitroglycerin, intravenous nitroprusside, nesiritide
- Hydralazine/isosorbide dinitrate
- Other inotropes such as dobutamine, dopamine, and milrinone (Note: these agents should be restricted to patients needing symptomatic relief and those who are no longer responding to other therapies.)
- Calcium channel blockers such as amlodipine (Note: other calcium channel blockers are specifically not recommended.)
- Anti-arrhythmics (Note: anti-arrhythmics with the exception of amiodarone and dofetilide are not recommended in congestive heart failure [CHF])
- Anticoagulants (warfarin)

3. Non-pharmacologic management including diet (including sodium restriction), daily weights, exercise, smoking cessation, coping with chronic disease, advanced directives, and end-of-life considerations
4. Evaluation and referral for revascularization
5. Referral to subspecialist for assistance in further management
6. Ongoing assessment of treatment and evaluation for symptom exacerbation
7. Emergent management including adjusting $O_2$, continuous or bilevel positive airway pressure
8. Management of acute pulmonary edema including loop diuretics, nitroglycerin or nesiritide, morphine sulfate, milrinone, dobutamine

### MAJOR OUTCOMES CONSIDERED

#### Diagnosis

Sensitivity, specificity, accuracy, and reproducibility of diagnostic tests

#### Treatment

- Hospitalization rates
- Morbidity and mortality
- Change in function and quality of life
- Change in symptoms
- Exercise capacity/tolerance
- Disease progression
- Safety of pharmacologic agents

## METHODOLOGY

### METHODS USED TO COLLECT/SELECT EVIDENCE

#### Searches of Electronic Databases

### DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Not stated

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Key conclusions (as determined by the work group) are supported by a conclusion grading worksheet that summarizes the important studies pertaining to the conclusion. Individual studies are classed according to the system presented below, and are designated as positive, negative, or neutral to reflect the study quality.

Conclusion Grades:

Grade I: The evidence consists of results from studies of strong design for answering the question addressed. The results are both clinically important and consistent with minor exceptions at most. The results are free of any significant doubts about generalizability, bias, and flaws in research design. Studies with negative results have sufficiently large samples to have adequate statistical power.

Grade II: The evidence consists of results from studies of strong design for answering the question addressed, but there is some uncertainty attached to the conclusion because of inconsistencies among the results from the studies or because of minor doubts about generalizability, bias, research design flaws, or adequacy of sample size. Alternatively, the evidence consists solely of results from weaker designs for the question addressed, but the results have been confirmed in separate studies and are consistent with minor exceptions at most.

Grade III: The evidence consists of results from studies of strong design for answering the question addressed, but there is substantial uncertainty attached to the conclusion because of inconsistencies among the results of different studies or because of serious doubts about generalizability, bias, research design flaws, or adequacy of sample size. Alternatively, the evidence consists solely of results from a limited number of studies of weak design for answering the question addressed.

Grade Not Assignable: There is no evidence available that directly supports or refutes the conclusion.

Study Quality Designations:

The quality of the primary research reports and systematic reviews are designated in the following ways on the conclusion grading worksheets:

Positive: indicates that the report or review has clearly addressed issues of inclusion/exclusion, bias, generalizability, and data collection and analysis.

Negative: indicates that these issues (inclusion/exclusion, bias, generalizability, and data collection and analysis) have not been adequately addressed.

Neutral: indicates that the report or review is neither exceptionally strong nor exceptionally weak.

Not Applicable: indicates that the report is not a primary reference or a systematic review and therefore the quality has not been assessed.

Classes of Research Reports:

A. Primary Reports of New Data Collection:

Class A:

- Randomized, controlled trial

Class B:

- Cohort study

Class C:

- Non-randomized trial with concurrent or historical controls
- Case-control study
- Study of sensitivity and specificity of a diagnostic test
- Population-based descriptive study

Class D:

- Cross-sectional study
- Case series
- Case report

B. Reports that Synthesize or Reflect upon Collections of Primary Reports:

Class M:

- Meta-analysis
- Systematic review
- Decision analysis
- Cost-effectiveness analysis

Class R:

- Consensus statement
- Consensus report
- Narrative review

Class X:

- Medical opinion

## METHODS USED TO ANALYZE THE EVIDENCE

Review of Published Meta-Analyses
Systematic Review with Evidence Tables

## DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not stated

## METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

## RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

## COST ANALYSIS

Published cost analyses were reviewed.

## METHOD OF GUIDELINE VALIDATION

Clinical Validation-Pilot Testing
Internal Peer Review

## DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Institute Partners: System-Wide Review

The guideline draft, discussion, and measurement specification documents undergo thorough review. Written comments are solicited from clinical, measurement, and management experts from within the member medical groups during an eight-week period of "Critical Review."

Each of the Institute's participating medical groups determines its own process for distributing the guideline and obtaining feedback. Clinicians are asked to suggest modifications based on their understanding of the clinical literature coupled with their clinical expertise. Representatives from all departments involved in implementation and measurement review the guideline to determine its operational impact. Measurement specifications for selected measures are developed by the Institute for Clinical Systems Improvement (ICSI) in collaboration with participating medical groups following general implementation of the guideline. The specifications suggest approaches to operationalizing the measure.

### Guideline Work Group: Second Draft

Following the completion of the "Critical Review" period, the guideline work group meets 1 to 2 times to review the input received. The original guideline is revised as necessary and a written response is prepared to address each of the suggestions received from medical groups. Two members of the Cardiovascular Steering Committee (CVSC) carefully review the Critical Review input, the work group responses, and the revised draft of the guideline. They report to the entire committee their assessment of two questions: (1) Have the concerns of the medical groups been adequately addressed? (2) Are the medical groups willing and able to implement the guideline? The committee then either approves the guideline for pilot testing as submitted or negotiates changes with the work group representative present at the meeting.

### Pilot Test

Medical groups introduce the guideline at pilot sites, providing training to the clinical staff and incorporating it into the organization's scheduling, computer, and other practice systems. Evaluation and assessment occur throughout the pilot test phase, which usually lasts for three months. Comments and suggestions are solicited in the same manner as used during the "Critical Review" phase.

The guideline work group meets to review the pilot sites' experiences and makes the necessary revisions to the guideline, and the Cardiovascular Steering Committee reviews the revised guideline and approves it for implementation.

## RECOMMENDATIONS

### MAJOR RECOMMENDATIONS

Note from the National Guideline Clearinghouse (NGC) and the Institute for Clinical Systems Improvement (ICSI): In addition to updating their clinical guidance, ICSI has developed a new format for all guidelines. Key additions and changes include: combination of the annotation and discussion section; the addition of "Key Points" at the beginning of most annotations; the inclusion of references supporting the recommendations; and a complete list of references in the Supporting Evidence section of the guideline. For a description of what has changed since the previous version of this guidance, refer to Summary of Changes -- August 2006.

The recommendations for the management of heart failure (HF) in adults are presented in the form of 3 algorithms: Heart Failure in Adults, Emergent Management, and Acute Pulmonary Edema with a total of 55 components, accompanied by detailed annotations. Clinical highlights and selected annotations (numbered to correspond with the algorithm) follow.

Class of evidence (A-D, M, R, X) and conclusion grade (I-III, Not Assignable) definitions are repeated at the end of the "Major Recommendations" field.

#### Clinical Highlights

- Evaluate patients presenting with heart failure (HF) for exacerbating and underlying causes including coronary artery disease, hypertension, valvular disease, and other cardiac and non-cardiac causes. (Annotation #2)
- Studies show that the distinction between systolic dysfunction and preserved systolic function is important because the choice of therapy may be quite different and some therapies for systolic dysfunction may be detrimental if used to treat preserved systolic function. (Annotation #2)
- After evaluation, diagnosis, and initiation of pharmacologic and non-pharmacologic management of heart failure, follow-up in the ambulatory setting should focus on optimizing pharmacologic and non-pharmacologic therapy and preventing heart failure exacerbations. Patient education is central in this effort. (Annotations #13, 14)
- Daily weights are critical for managing heart failure and early detection of increases in fluid retention. Patients should call their provider for a 2-pound or greater weight gain over night or a 5-pound or greater weight gain in a week. (Annotation #14)
- Unless specific contraindications exist, treat all patients, including Class IV patients, with beta-blockers starting with a low dose and titrate upward. Do not unnecessarily reduce or discontinue beta-blockers in severe or decompensated heart failure. After fluid overload and hypotension corrected and when only one drug can be initiated, beta-blockers are preferred. (Annotation #13)
- Treat all patients with left-ventricular systolic dysfunction with angiotensin-converting enzyme (ACE) inhibitors (or angiotensin receptor blockers [ARBs] if intolerant) unless specific contraindications exist such as intolerance or adverse reactions to ACE inhibitors, serum potassium greater than 5.5 mEq/L, symptomatic hypotension, severe renal artery stenosis, or pregnancy. Gradually titrate dose up over a two- to three-month period. (Annotations #13)
- Consider treatment with aldosterone antagonists for Class III and IV heart failure patients with appropriate follow-up. (Annotation #13)
- Consider early specialty referral for patients with ischemia or those who are refractory despite optimal medical therapy. (Annotation #11)
- Brain natriuretic peptide (BNP) and proBNP is useful in the diagnosis and prognosis of heart failure in patients with dyspnea of unknown etiology. (Annotation #2)

## Heart Failure Algorithm Annotations

1. Signs and Symptoms of Heart Failure (Excluding Acute Coronary Syndrome)

   Signs and Symptoms of Congestion:

   - Dyspnea
   - Orthopnea
   - Paroxysmal nocturnal dyspnea
   - Cough (recumbent or exertional)
   - Abdominal or epigastric discomfort
   - Abdominal bloating (ascites)
   - Early satiety
   - Hemoptysis, frothy or pink-tinged sputum

- Pedal/leg swelling
- Weight gain (rapid)
- Sleep disturbances (anxiety or air hunger)
- Chest tightness or discomfort
- Unexplained confusion, altered mental status, or fatigue
- Nausea or anorexia
- Dependent edema

Signs and Symptoms of Poor Perfusion/Low Cardiac Output:

- Easy fatigability
- Poor energy level or endurance
- Decreased exercise tolerance
- Cachexia
- Muscle wasting or weakness
- Nausea or anorexia
- Early satiety
- Weight loss, unexplained
- Malaise
- Impaired concentration or memory
- Sleep disturbance
- Altered mentation (somnolence, confusion)
- Resting tachycardia
- Daytime oliguria with recumbent nocturia
- Cool or vasoconstricted extremities
- Cheyne-Stokes respiration (with or without apnea)

See Appendix B in the original guideline document for the New York Heart Association (NYHA) Classification and American College of Cardiology/American Heart Association (ACC/AHA) Staging System.

2. Initial Evaluation

Key Points:

- The diagnosis of heart failure should not be a single diagnosis. It is important to identify the etiology or precipitating factors as a cause of heart failure.
- It is important to determine whether ventricular dysfunction is systolic or diastolic as therapies are quite different. Some therapies for systolic dysfunction may even be harmful if used to treat preserved systolic function.
- Ischemia is responsible for the majority of cases of heart failure. Two-thirds of systolic heart failure is due to ischemic heart disease. Identifying ischemia as a cause of heart failure is important, as a majority of these patients would benefit from revascularization.

The purpose of the initial evaluation, whether in the inpatient or outpatient setting should be to confirm a diagnosis of heart failure and identify an etiology/precipitating factor(s).

Early triage should be performed to determine whether emergent or inpatient care is needed. Early identification of acute ischemia as the cause of heart failure is important as prompt reversal of ischemia may impact outcome.

Consider consultation with cardiology during the initial evaluation and any time that it is felt appropriate in the ongoing management of HF patients.

Questions to Determine Severity:

A. History

Presenting Symptoms:

- Dyspnea/paroxysmal nocturnal dyspnea (PND)/orthopnea
- Recent weight gain
- Chest pain
- Palpitations
- Blood loss/causes of anemia
- Recent fevers/viral infection
- Cough/sputum production
- Claudication
- Exercise tolerance
- Fatigue
- Edema/ascites
- Color changes

Past Medical History:

- History of congestive heart failure (CHF)
- History of myocardial infarction (MI)
- Cardiac risk factors
- Hypertension/smoking/diabetes/hyperlipidemia
- History/risk factors for thromboembolic disease
- History of thyroid dysfunction
- Recently postpartum
- History of snoring/sleep apnea
- Blunt chest injury
- Rheumatic fever
- Human immunodeficiency virus (HIV)
- Bacterial endocarditis
- Claudication
- Screen for depression
- Foreign travel

Family History:

- Screen for family history of ischemic heart disease, CHF, congenital heart disease, risk factors for arteriosclerotic cardiovascular disease (ASCVD) and CHF

Social History:

- Smoking
- Alcohol use/abuse screen
- Drug abuse

Dietary History:

- Salt and daily fluid intake
- Balanced diet

B. Physical Exam:
- Vital signs, including weight and height
- Diaphoresis
- Diminished peripheral pulse or bruit
- Skin color: cyanosis, pallor, jaundice
- Lower extremity edema in the absence of venous insufficiency
- Elevated jugular venous pressure, positive hepato-jugular reflux
- Heart rate: tachycardia, bradycardia/arrhythmias
- Left lateral displacement of the point of maximal impulse (PMI)
- Heart sounds - S3, S4, murmur
- Lungs: labored breathing, rales above the lower 25% of the lung that do not clear with cough
- Abdomen - large, pulsatile, tender liver or ascites

C. Initial Laboratory Evaluation:
- Initial
  - Complete blood count
  - Electrolytes ($Na^+$, $K^+$, $Cl^-$, Bicarbonate, $Ca^{++,}$ $MG^{++}$ if on diuretics)
  - Renal function (blood urea nitrogen [BUN], creatinine [Cr])
  - Liver function (aspartate transaminase [AST], alanine transaminase [ALT], alkaline phosphatase, bilirubin, T Prot, albumin)
  - Urinalysis
  - Sensitive thyroid-stimulating hormone (sTSH)
  - Prothrombin time/international normalized ratio (PT/INR)
- Inpatient/Emergency Department
  - Arterial blood gases
  - Tests for myocardial injury: troponin, creatine kinase/creatine kinase muscle band (MB) (CK/CKMB)
  - Brain natriuretic peptide (BNP)
- Other Causes
  - Ferritin/iron/total iron-binding capacity (TIBC)/macrocytic anemias
  - Lipid profile
  - Blood culture if endocarditis suspected
  - Lyme serology (if suspect bradycardia/heart block)
  - Connective tissue disease work up
  - HIV

Refer to the original guideline document for information on ACC/AHA heart failure grading.

Role of Brain Natriuretic Peptide (BNP) in the Diagnosis and Management of Heart Failure

Brain natriuretic peptide (BNP) and ProBNP assays have been found useful in the diagnosis of patients with dyspnea of unknown etiology. Since BNP and ProBNP concentrations correlate positively with cardiac filling pressures, measurement of a low concentration make it unlikely that dyspnea is due to cardiac dysfunction. The BNP test is helpful in ruling out a cardiac cause when the BNP level is less than 100 pg/mL. BNP is correlated with severity of heart failure in patients with heart disease.

Refer to the original guideline document for more details on the role of BNP in the diagnosis and management of heart failure.

Evidence supporting this recommendation is of classes: A, C, D

D. Diagnostic Tests:
    - Electrocardiogram
    - Chest radiograph
    - Assessment of ventricular function (echocardiogram, radionuclide ventriculography)
        - It is reasonable to reassess ejection fraction (EF) if patient is clinically decompensated or after patient has been titrated up to target doses of beta-blockers and ACE inhibitors.
    - Ischemia evaluation in patients with coronary artery disease (CAD) risk factors (stress test, angiography).Refer to the National Guideline Clearinghouse (NGC) summary of the Institute for Clinical Systems Improvement (ICSI) guideline Diagnosis and Treatment of Chest Pain and Acute Coronary Syndrome (ACS), and Cardiac Stress Test Supplement.
    - An electrocardiogram (ECG) and chest radiograph are fundamental parts of the initial evaluation for heart failure. In addition, the objective evaluation of ventricular performance is also a critical part for patients with suspected or known heart failure. Objective assessment of left ventricular (LV) function is necessary because Chest x-ray (CXR), ECG, and history and physical examination (H&P) often fail to distinguish normal from low EF in patients with heart failure.

Evidence supporting this recommendation is of classes D, M, R

Refer to the original guideline document for additional information on specific etiologies of ventricular dysfunction, interpretation of ventricular function testing, and measurement techniques.

E. Assess for Causative and Precipitating Factors

Causes of heart failure can be classified as cardiac and non-cardiac. Refer to tables 2 and 3 in the original guideline document for the salient features of the more common causes.

It is important to make a determination whether heart failure is due to systolic dysfunction or preserved systolic function. One-third of patients have predominantly preserved systolic function, one-third have both diastolic and systolic dysfunction, and one-third have predominantly systolic dysfunction.

Ischemia is responsible for the majority of cases of heart failure. Two-thirds of systolic heart failure is due to ischemic heart disease. Identifying ischemia as a cause of heart failure is important, as a majority of these patients would benefit from revascularization.

3. Unstable Signs and Symptoms Requiring Emergent Management?

Unstable symptoms may include:

- Dyspnea: at rest/orthopnea (change from baseline), sudden onset of shortness of breath (sob), worsening sob, exertional dyspnea, gasping
- $SaO_2$ less than 90%
- Coughing up pink/frothy sputum
- Dizziness or syncope
- Chest pain
- Systolic blood pressure (BP) less than 80-90 and symptomatic
- Evidence of hypoperfusion (cyanosis, decreased level of consciousness, etc.)

Assess Blood Pressure, Perfusion, and Volume Status

Refer to Figure 1 in the original guideline document for clinical classification of the mode of heart failure.

5. Admit to Hospital if Necessary

Consider hospitalization in the presence or suspicion of heart failure with any of the following findings:

- Clinical, laboratory, or electrocardiographic evidence of acute myocardial ischemia or infarction
- Severe symptoms of heart failure refractory to outpatient therapy
- Pulmonary edema or severe respiratory distress
- Thromboembolic complications requiring interventions
- Severe complicating medical illness (e.g., pneumonia, renal failure)
- Management of clinically significant arrhythmias (hemodynamic effects)
- Anasarca (generalized edema)
- Inadequate social support for safe outpatient management
- Symptomatic hypotension or syncope
- Hyperkalemia

By definition, these patients are Stage C and D, NYHA Class III or IV. (See Appendix B in the original guideline document for the New York Heart Association Classification and ACC/AHA Staging System.) Heart failure should not be the final, stand-alone diagnosis. There should always be an associated etiology and/or contributing factor. The etiology of heart failure and the presence of exacerbating factors or other diseases that may have an important influence on management should be carefully considered in all cases.

6. Initiate Heart Failure Management
   A. Pharmacologic Management of Heart Failure:

ACE Inhibitors

- Beneficial subsets: NYHA Class I-IV

  ACE inhibitors slow disease progression, improve exercise capacity, and decrease hospitalizations and mortality. [Conclusion Grade I: See Conclusion Grading Worksheet D - Annotations # 6 and 13 (ACE Inhibitors) in the original guideline document.]

Angiotensin II Receptor Antagonists

- Beneficial subsets: NYHA Class I-IV. Reduce afterload and improve cardiac output. Can be used for patients with ACE inhibitor cough.

Hydralazine/Isosorbide Dinitrate

- Beneficial subsets: Patients intolerant to ACE inhibitors

Diuretics

- Beneficial subsets: Fluid overload (edema, ascites, dyspnea, weight gain)

Aldosterone Antagonists

- Beneficial subsets: NYHA Class III-IV

Digoxin

- Beneficial subsets: NYHA Class II-IV; patients with atrial fibrillation; patients with S3 gallop, left ventricular (LV) dilatation, high filling pressures

Digitalis improves symptoms, exercise tolerance, and quality of life, but neither increases nor decreases mortality. [Conclusion Grade I: See Conclusion Grading Worksheet E - Annotations #6 and 13 (Digitalis) in the original guideline document.]

Beta-Blockers

- Beneficial subsets: Stable NYHA Class I-IV

Refer to the original guideline document for information on initially daily doses and optimal (target) daily doses.

B. Treatment of Systolic Dysfunction

The cornerstone of treatment is the use of beta-blockers and ACE inhibitors. Certain beta-blocking medications have been shown to improve clinical symptoms and ventricular function in patients with systolic dysfunction.

Beta-blockers decrease hospitalizations and mortality and have objective beneficial effect on measures of exercise duration. [Conclusion Grade I: See Conclusion Grading Worksheet C – Annotation #6 (Beta-blockers and Exercise) in the original guideline document]

ACE inhibitors prolong life in patients with HF symptoms and EF less than 35% and reduce symptom development in asymptomatic patients with EF less than 35%.

There is also a mortality benefit in the use of ACE inhibitors in patients with recent myocardial infarction and asymptomatic EF less than 40%.

ACE inhibitors slow disease progression, improve exercise capacity, and decrease hospitalizations and mortality. [Conclusion Grade I: See Conclusion Grading Worksheet D - Annotations #6 and 13 (ACE Inhibitors) in the original guideline document]

Refer to the original guideline for additional information on treatment of systolic dysfunction.

Evidence supporting this recommendation is of classes: A, D

C. Treatment of Heart failure with Preserved Systolic Function (Preserved systolic function)

For the management of preserved systolic function it is particularly important to address the underlying etiology. Ischemia and hypertension must be optimally controlled. Pericardial disease must be specifically treated if present. Control of atrial tachyarrhythmias may be of particular importance since these patients need adequate time for diastolic filling and tolerate tachycardias poorly. Beta-blockers may be of value to slow the heart rate and allow a longer time interval for diastolic filling.

In general, drugs used to treat systolic dysfunction (ACE, ARBs, diuretics, beta-blockers) are generally found to be effective in patients with heart failure with preserved systolic function.

Diuretics may be helpful to control volume overload and edema. They should be used in the lowest dose needed since excessive diuresis may cause orthostatic hypotension or prerenal azotemia. Arteriolar vasodilators or venodilators should be used with caution as they may cause serious hypotension.

Patients with hypertrophic cardiomyopathy should be identified and may benefit from genetic counseling. Patients with hypertrophic cardiomyopathy may benefit from beta-blockers to slow heart rate. Some may benefit from verapamil or disopyramide if beta-blockers are not effective. In cases of significant intracavitary pressure gradients, dual chamber pacing or septal myectomy surgery may be indicated.

Particular attention must be given to the control of atrial tachyarrhythmias. Care should be taken to avoid venodilators and arterial vasodilators.

See Annotation #13, "Pharmacologic Management" for inpatient medications.

Evidence supporting this recommendation is of classes: A, C

For patients with predominant heart failure with preserved systolic function:

1. Treat specific contributing causes:
    - Hypertension (goal is blood pressure of 130/85). See also the NGC summary of the ICSI guideline Hypertension Diagnosis and Treatment.
    - Ischemic heart disease
    - Hypertrophic cardiomyopathy - consider referral to subspecialist (for verapamil, disopyramide, surgical myectomy, pacemaker)
    - Constrictive pericarditis

2. Pharmacologic management for preserved systolic function:

    ACE Inhibitors

    - Beneficial subsets: NYHA Class I-IV. Use with caution as they may cause serious hypotension.

    Angiotensin II Receptor Antagonists

    - Beneficial subsets: NYHA Class I-IV. Reduce afterload and improve cardiac output. Can be used for patients with ACE inhibitor cough.

Diuretics

- Beneficial subsets: Use with caution to manage fluid retention but not at doses which cause significant orthostatic hypotension or prerenal azotemia.

Beta Blockers

- Beneficial subsets: Patients with atrial fibrillation

See original guideline document for dosing comments.

(See also Annotation #13 for further description of pharmacologic management.)

7. Coronary Artery Disease (CAD) Known or Suspected and Potential Revascularization Candidate?

   Refer to the NGC summary of the ICSI guideline Stable Coronary Artery Disease.

11. Consider Specialty Referral/Out of Guideline

    Key Points:

    - Primary care providers should continue to be involved in the decision making process when subspecialty consultation and management is necessary.
    - Communication between the primary care giver and the cardiologist is key and should be encouraged even before the need for a referral in order to integrate seamless diagnostic and therapeutic care.

    Once it has been determined that the patient is a candidate for revascularization, the next step is angiography performed by a cardiologist. Subspecialty consultation will generally involve not only performance of the procedure, but also recommendation for further management. Primary care providers should continue to be involved in the decision making process. Primary care providers should also be familiar with risks associated with various patterns of disease distribution seen on angiogram. The decision to proceed with revascularization must be determined on an individual basis. Consultation should take place among the patient, primary care provider, cardiologist, and cardiovascular surgeon to determine the most appropriate course of action.

    If the results of the angiogram do not show significant CAD or if the decision is made not to proceed with revascularization, pharmacological management should be continued (see Annotation #13, "Pharmacologic Management").

    Patients with advanced structural heart disease and marked symptoms of heart failure at rest despite maximum medical therapy and who require

specialized interventions are outside of this guideline. These are primarily Stage D classed patients.

- Assumes that all recommendations for Stages A, B, C have been maximized, including utilization of neurohormonal inhibitors.
- Management of fluid status has been aggressively pursued.
- Accuracy of Stage D diagnosis is confirmed.
- Any contributing conditions have been identified and treated.

Refer to the original guideline document for additional information on surgical procedures; left ventricular assist devices; continuous infusions of positive inotropic agents such as dobutamine, dopamine, or milrinone; hospice; and when to consider referral to subspecialist.

12. Treat Secondary Causes of HF and Significant Comorbid Conditions and Risk Factors

    Treat as indicated by the particular disease state. Specific treatment modalities for secondary causes of HF are considered outside of the scope of this guideline. See Table 2: Cardiac Related Causes of HF with Reduced Systolic Function and Table 3: Non-Cardiac Related Causes in the original guideline document. See also the NGC summary of the ICSI guideline Hypertension Diagnosis and Treatment.

13. Pharmacologic Management

    Key Points:

    - Carvedilol, metoprolol succinate (extended release), and bisoprolol have demonstrated reductions in mortality over other generic beta blockers for patients with all classes of heart failure.
    - ACE inhibitors should be prescribed for all patients with left ventricular systolic dysfunction unless specific contraindications exist. An elevated baseline creatinine is not a specific contraindication.
    - ACE inhibitors are more effective in decreasing heart failure mortality than the isosorbide dinitrate/hydralazine combination.
    - Angiotensin receptor blockers should be considered primarily for patients who are intolerant of ACE inhibitors or those receiving standard drug therapy (including ACE inhibitors) who continue to show clinical deterioration.
    - Routine use of angiotensin receptor blockers with ACE inhibitors and aldosterone antagonists cannot be recommended.
    - Diuretics should not be the sole therapy for patients with signs of volume overload, and vasoactive drugs should also be considered.
    - Loop diuretics are more effective in severe heart failure than thiazide diuretics, and combination therapy with thiazide (or thiazide-like medication) and loop diuretic may be used in refractory cases of volume overload.
    - Aldosterone blocking agents (spironolactone, eplerenone) reduce mortality in patients with Class III-IV heart failure for patients on stable doses of digoxin and ACE inhibitors.

- Currently, the work group recommends that nesiritide be reserved for patients with acutely decompensated heart failure who remain volume overloaded despite aggressive treatment, display tolerance and/or resistance to vasodilators or diuretics, or demonstrate significant side-effects to other vasodilators.
- ACE inhibitors should be prescribed for all patients with left ventricular systolic dysfunction unless specific contraindications exist. Studies show ACE inhibitors mare widely underprescribed.
- Calcium channel blockers should be used with caution in patients with heart failure.

Beta-Blockers

- When only one drug can be initiated, beta blockers are preferred.
- Studies strongly support use of certain beta-blockers which have demonstrated reductions in mortality (e.g., carvedilol, metoprolol succinate [extended release], bisoprolol) in patients with Class I-IV CHF. Recent data from COMET demonstrated carvedilol to have a 17% risk reduction in mortality over metoprolol tartrate (immediate release).
- The beta blocker should be started as soon as the patient is stable (without fluid overload or hypotension).
- After appropriate stabilization, it may be safe to start beta-blockers in the inpatient setting. Beta-blockers decrease hospitalizations and mortality. [Conclusion Grade I: See Conclusion Grading Worksheet F - Annotation #13 (Beta Blockers and Inpatient Setting) in the original guideline document]
- Beta blockers should be started at low initial doses and titrated up gradually at rates consistent with those from key studies.
- Do not unnecessarily reduce or discontinue the dose of beta-blocker.
- If significant bradycardia/atrioventricular (AV) block occurs with use of beta- blockers, dose may need to be decreased. If hypotension or fluid retention occurs, either the dose of beta-blocker, ACE inhibitor, or diuretics should be adjusted as clinically appropriate.
- Patients should be informed that positive effects of beta-blockers may not be seen until several months after titration to target dose.
- Beta-blockers have objective beneficial effect on measures of exercise duration.
- Beta-blockers have been shown to decrease mortality and reinfarction among patients with compensated HF following acute myocardial infarction.
- Beta-blockers have been shown to improve hemodynamics in patients with idiopathic dilated cardiomyopathy.
- For rate control in tachycardia induced heart failure, the work group prefers beta-blockers over other agents.

Evidence supporting this recommendation is of classes: A, M

Carvedilol

- The COMET trial demonstrated carvedilol to have a 17% risk reduction in mortality over metoprolol tartrate.

- Recommended starting dose for carvedilol is 3.125 mg twice daily for two weeks. Dosage can be doubled every two weeks to highest level tolerated by patient to maximum 25 mg twice daily (less than 85 kg) or 50 mg twice daily (greater than 85 kg). It is suggested that after initiation of each new dose, patients should be observed for signs of dizziness or lightheadedness. Also consider instructing patients to take carvedilol two hours before ACE inhibitors to decrease potentiating effects. Carvedilol should be taken with food to slow the rate of absorption and reduce the risk of postural hypotension.
- There are now prospective randomized controlled data available for carvedilol that have shown a reduction in hospitalization and death from heart failure.

Evidence supporting this recommendation is of class: M

Metoprolol Succinate

- In the MERIT HF study of metoprolol succinate compared to placebo, a mortality reduction was shown at one year in patients with NYHA Class II-IV heart failure.
- There are no head to head trials comparing carvedilol and metoprolol succinate (extended release).
- Recommended starting dose of metoprolol succinate is 25 mg/once daily. In patients with more severe heart failure (NYHA Class III or IV) recommended starting dose is 12.5 mg/once daily. The dose may then be doubled every 2 weeks up to the highest tolerated dose or up to 200 mg/once daily.

Evidence supporting this recommendation is of classes: A, M

Vasodilators

ACE Inhibitors

- ACE inhibitors are widely underprescribed.
- ACE inhibitors should be prescribed for all patients with left-ventricular systolic dysfunction unless specific contraindications exist.
- Contraindications include:
    1. History of intolerance or adverse reactions to these agents
    2. Serum potassium greater than 5.5 mEq/L
    3. Symptomatic hypotension (unless due to excessive diuresis)
    4. Severe renal artery stenosis
    5. Pregnancy
    6. Cough and rash side effects
- ACE inhibitors should be prescribed or ARBs if contraindications exist.
- To optimize mortality reductions possible with ACE inhibitors, the dose must be titrated to the moderate to high dose range (e.g., 20 to 40 mg Lisinopril daily). Lower dose therapy has been shown to be less effective in reducing mortality.
- Approach to initiating ACE inhibitor therapy:

    1. Start at a low dose and titrate upward over several weeks to targeted moderate to high doses and maximum tolerated dose.
    2. Consider holding one dose of diuretic before giving the first dose of ACE inhibitors, particularly in patients with low baseline blood pressure.
- Hypotension. Patients should be well hydrated before initiation or increase of ACE inhibitors. If the patient develops hypotension in the absence of hypovolemia, splitting the dose or switching from morning (a.m.) to bedtime (h.s.) dosing (in long-acting agents) may be helpful. If this is ineffective, the dose should be reduced to the highest dose tolerated.
- Periodically monitor for changes in renal function and potassium as well as other electrolytes with these agents - especially when titrating doses and when concomitantly administered with other agents known to affect electrolytes (diuretics, ACE inhibitors, angiotensin blocking agents, aldosterone antagonists).
- Renal Insufficiency. Creatinine should be monitored regularly in patients on ACE inhibitors, and more frequently during active titration. An increase in serum creatinine of 0.5 mg/dL or more is an indication for reassessment of volume status. There is no absolute level of creatinine to preclude the use of ACE inhibitors.
- All ACE inhibitors that have been studied to date in treatment of HF have shown benefit. Therefore, simpler dosing regimens may be equally effective and less expensive.
- For patients with asymptomatic or mildly symptomatic decreases in left ventricular (LV) systolic performance, use of ACE inhibitors has been shown to decrease mortality, progression of HF, and need for hospitalization.
- In the general population, ACE inhibitors are more effective in decreasing HF mortality than the isosorbide dinitrate/hydralazine combination.
- In studies demonstrating decreased mortality in HF relatively high doses of ACE inhibitors were used.
- Enalapril 20 mg daily (twice daily dosing)
- Captopril 100 to 150 mg daily (three times daily dosing)
- ACE inhibitors slow disease progression, improve exercise capacity, and decrease hospitalizations and mortality. [Conclusion Grade I: See Conclusion Grading Worksheet E- Annotations #6 and 13 (ACE Inhibitors) in the original guideline document]

Evidence supporting this recommendation is of class: A

Angiotensin Receptor Blockers (ARB)

- ARBs are to be used if ACE inhibitors are not tolerated.
- Based on the findings of the series of Candesartan in Heart Failure Assessment of Reduction in Mortality and Morbidity (CHARM) studies, recommendations to consider adding an angiotensin receptor blocker to standard optimized drug therapy for those with systolic dysfunction may be supported. An ARB is the preferred alternative to hydralazine/isosorbide dinitrate in most patients because of ease of

use except in renal dysfunction, hyperkalemia, and possibly in African-Americans.

- Specifically, according to the CHARM-Added trial, there is a benefit in terms of composite cardiovascular endpoints when adding ARB to a regimen of an ACE inhibitor and beta-blockers (triple therapy). This observation is consistent overall, with the results of the Val-HeFT study. In spite of subgroup analysis from Val-HeFT suggesting that the addition of an ARB to the ACE inhibitor and beta- blocker may have resulted in a negative effect on both mortality and morbidity, the group feels that, based on the findings from the CHARM-Added study, the combination of ARBs to an ACE inhibitor and beta-blocker regimen is more favored than disfavored at this time.
- Only valsartan and candesartan are approved for use in patients with heart failure.
- Direct comparison with regards to mortality in patients with HF showed no difference between the ARB losartan and captopril.
- According to the Valsartan In Acute Myocardial Infarction (VALIANT) trial, 2003, there is no benefit when adding ARB to ACE inhibitors in early post MI patients.
- Contraindications to ARBs include history of intolerance or adverse reactions to serum potassium greater than 5.5 meq/L, symptomatic hypotension (unless due to excessive diuresis), severe renal artery stenosis, and pregnancy.

Evidence supporting these recommendations is of class: A

Diuretics

- Patients with signs of volume overload should be started on a diuretic; however, this should not be sole therapy.
- Severe volume overload, severe renal insufficiency (creatinine clearance less than 30 mL/min), or persistent edema despite thiazide diuretics are all indications to use a loop diuretic.
- Combination therapy that combines a thiazide or a thiazide-like medication such as metolazone with a loop diuretic may be used in refractory cases of volume overload.
- Periodically monitor for changes in renal function and potassium as well as other electrolytes with these agents - especially when titrating doses and when concomitantly administered electrolytes (diuretics, ACE inhibitors, angiotensin blocking agents, and aldosterone antagonists).
- Excessive diuresis may result in:
    - Prerenal azotemia
    - Orthostatic hypotension
    - Hypokalemia and hypomagnesemia
    - Inability to achieve optimal dose of ACE inhibitor
    - Activation of the renin-angiotensin-aldosterone (RAAS) system
- Fluctuating volume status may necessitate ongoing diuretic adjustment that requires frequent monitoring for electrolyte imbalances and hypotension.
- In patients refractory to furosemide, a combination of oral or intravenous (IV) thiazide diuretics to block the distal tubules followed

one hour later by a loop diuretic may be beneficial in achieving diuresis.
- Diuretic effectiveness may be increased by 1 to 2 hours of bed rest (supine position) after taking diuretics.
- Hyponatremia is an indication for fluid restriction in a volume-overloaded patient and a decrease in diuretic in a volume-depleted patient.
- Hyperkalemia may be the result of too much potassium supplementation, potassium-sparing diuretics, digoxin toxicity, ACE inhibitor or ARB use, or renal insufficiency.
- Hypomagnesemia often accompanies hypokalemia. If high doses of diuretic are used, serum magnesium levels should be checked regularly and oral supplementation given as indicated. Hypomagnesemia may prevent correction of hypokalemia.
- Orthostatic hypotension may indicate overdiuresis in the absence of congestive symptoms and may be accompanied by an increased blood urea nitrogen to creatinine ratio. If volume depletion is not present, intolerance of the ACE inhibitor is likely (see "ACE Inhibitors").

Evidence supporting these recommendations is of classes: A, C, D

Aldosterone Blocking Agents

Spironolactone

- A multi-center, randomized clinical trial showed a reduction in mortality among patients with Class III-IV HF who were treated with spironolactone 25 to 50 mg per day. These patients were already on stable doses of digoxin and ACE inhibitors. In the RALES study, 25 mg per day of spironolactone was found to decrease morbidity and mortality. The mechanism is felt to be due to inhibition of aldosterone effects on myocardial cell death. Hyperkalemia is a side effect of spironolactone and potassium levels should be checked 3 to 7 days after starting the drug

Eplerenone

- Eplerenone, a selective aldosterone antagonist with fewer endocrine side effects than spironolactone, was evaluated in the EPHESUS trial. It was used in study subjects who had a myocardial infarction 3 to 14 days prior and had a left ventricular ejection fraction (LVEF) less than 40% with evidence of HF (in 90%) and/or diabetes mellitus. Patients with a plasma creatinine greater than 2.5 mg/dL or $K^+$ over 5 mEq/L were excluded. The starting dose was 25 mg/day, increased to 50 mg/day after 4 weeks. There was a significant lower rate of all cause mortality (14.4%) due to reduction in cardiovascular mortality, reduction in sudden cardiac death, decreased mortality and hospitalizations for HF. Most patients in this trial (unlike RALES) were on an ACE Inhibitor, A2 blocker and a beta-blocker
- The mean LVEF in EPHESUS was 33% (compared to 25% in RALES), suggesting that patients with less severe heart failure than seen in the RALES trial, might benefit from aldosterone antagonism. The NYHA

class in the EPHESUS trial could not be established as most patients had an MI 2 weeks prior to enrollment.
- The current recommendation would be to use spironolactone for patients who fulfill the RALES criteria (current or recent NYHA class 4 HF, class 3 HF with patient being in class 4 HF in the past 6 months, preserved renal function, or reduced potassium concentration). Eplerenone could be used for patients (who have had a recent MI, LVEF less than 40%, and symptomatic HF and/or diabetes) as a pharmacologic alternative to spironolactone with less risk of gynecomastia. However, the cost and lack of outcome studies in the heart failure area would be a limiting factor.

Evidence supporting these recommendations is of class: A

Inotropes

Digoxin

- Digoxin is a useful drug in heart failure patients with atrial fibrillation with a rapid ventricular response.
- Digoxin in combination with ACE inhibitors has been shown to be of benefit in regard to hospitalization heart failure patients.
- The initiation of digoxin in asymptomatic heart failure patients still remains unsupported by clinical trials.
- Loading doses are generally not needed and steady state generally takes one week to reach (longer in patients with renal impairment).
- Serum levels of 0.7 to 1.5 ng/mL are considered therapeutic. Serum levels do not always correlate to symptoms of digoxin toxicity.
- Monitor for symptoms of toxicity (nausea, confusion, visual disturbance, anorexia), reduction of renal function, or conduction abnormality.
- To avoid digitalis toxicity, care should be used to use lower doses in the elderly and those with renal impairment, check digitalis level in one to two weeks after start of therapy in elderly or renal-impaired patients, and beware of drug interactions with new medications.
- Post hoc retrospective analysis of mortality statistics regarding the use of digoxin in heart failure indicate that the drug may actually increase mortality in women when compared to placebo. There are no randomized, prospective studies to confirm gender-based differences, but practitioners may want to consider this information when prescribing digoxin to women. If digoxin therapy is to be continued in women, it may be reasonable to recommend that lower dosing (0.125 mg per day) should be used and lower serum levels (1.0 or less) should be maintained.

Evidence supporting this recommendation is of class: A

Other Vasodilators

- Alpha-adrenergic blockers (prazosin, terazosin) have not demonstrated survival or functional benefit in the treatment of HF

Nitroglycerin (Intravenous)

- Food and Drug Administration (FDA) Indication: Intravenous nitroglycerin is indicated for the treatment of heart failure in patients with concomitant acute myocardial infarction.
- Non FDA indication: Nitroglycerin can be used to treat pulmonary edema.
- Following acute MI, early parenteral nitrate therapy has been documented to result in a lower incidence of new heart failure. Intravenous nitroglycerin is the only dosage form approved in the U.S. for use in heart failure associated with acute myocardial infarction, although sublingual, transmucosal, and transdermal dosage forms have been used for both acute and chronic symptomatic control.
- Nitroglycerin is normally reserved for patients whose cardiac index is adequate but pulmonary wedge pressure is elevated (greater than 18 mm Hg). A combination of diuretics and nitroglycerin or nitrates is effective in lowering pulmonary capillary wedge pressure.
- In one study versus nitroprusside, results supported a preference for nitroglycerin over nitroprusside for the treatment of heart failure and/or acute hypertension complicating acute myocardial infarction.
- Severe hypotension, particularly with upright posture, may occur even with small doses of nitroglycerin. The drug, therefore, should be used with caution in subjects who may have volume depletion from diuretic therapy or in patients who have low systolic blood pressure (e.g., below 90 mm Hg).
- Paradoxical bradycardia and increased angina pectoris may accompany nitroglycerin-induced hypotension. Nitrate therapy may aggravate the angina caused by hypertrophic cardiomyopathy.
- Tolerance to this drug and cross-tolerance to continuous use of other nitrates may occur within days.

Evidence supporting this recommendation is of classes: A, M, R

Nitroprusside (Intravenous)

- Nitroprusside is FDA indicated for the treatment of acute congestive heart failure.
- Nitroprusside has been shown to cause significant and sustained symptomatic improvement in severe, refractory heart failure due to a variety of causes. However, in acute MI patients with subsequent left ventricular failure, the use of nitroprusside has been associated with an increase in mortality in one study. Due to this study and the well-known propensity for nitroprusside to induce a "coronary steal syndrome," it is recommended to avoid use of nitroprusside in patients experiencing ischemia.

Evidence supporting this recommendation is of classes: A, D, R

Nesiritide (Natrecor®)

- Nesiritide is FDA approved for the intravenous treatment of patients with acutely decompensated heart failure who have dyspnea at rest or with minimal activity.
- In patients hospitalized with decompensated heart failure, nesiritide was shown to improve hemodynamic function and clinical status. When added to standard care in patients hospitalized with acutely decompensated heart failure, one study confirmed that nesiritide significantly reduced pulmonary capillary wedge pressure more than nitroglycerin or placebo. These effects were sustained for at least 24 hours.
- In comparison with dobutamine, nesiritide causes significantly fewer heart rate variances, tachycardia, premature ventricular beats, repetitive beats, and neurohormonal activation. In comparison to dobutamine, nesiritide is associated with a shorter treatment course, the use of fewer additional parenteral agents, a lower hospitalization rate, and a significantly lower mortality rate at 6 months.
- Compared with noninotrope-based control therapy, nesiritide may be associated with an increased risk of death after treatment for acutely decompensated heart failure. Until further studies can be done, it is the opinion of this group that other vasodilators and/or diuretics be attempted prior to a trial of nesiritide.
- If nesiritide is to be used, the best candidates for therapy are patients with decompensated heart failure who have clinical evidence of fluid overload and/or raised central venous pressure.
- There is little experience with infusions of nesiritide for more than 48 hours.
- In patients with severe heart failure whose renal function may depend on the activity of the renin-angiotensin-aldosterone system, treatment with nesiritide may be associated with azotemia.

Evidence supporting this recommendation is of classes: A, R

Hydralazine/Isosorbide Dinitrate

- Hydralazine/isosorbide dinitrate may be considered as a therapeutic option in those patients experiencing hyperkalemia or renal insufficiency secondary to ACE inhibitor, and possibly ARB usage.
- There is favorable evidence for the use of a fixed dose of hydralazine + isosorbide dinitrate in African-Americans with Class III and IV heart failure.
- If higher doses of ACE inhibitors or ARBs are not tolerated despite euvolemia, then a lower dose should be continued and/or a trial of hydralazine/isosorbide dinitrate instituted.
- Hydralazine combined with isosorbide dinitrate has been shown to reduce mortality and increase exercise tolerance in patients with symptomatic HF.

Evidence supporting this recommendation is of class: A

Other Inotropes

The inotropes dobutamine, dopamine, and milrinone have failed to demonstrate the ability to improve mortality in the treatment of severe decompensated heart failure. A review of the literature has in fact shown an increase in mortality with the use of these agents. [Conclusion Grade I: See Conclusion Grading Worksheet G - Annotation #13 (Inotropes) in the original guideline document]. The use of these inotropes should therefore be restricted to those patients needing symptomatic relief and who are no longer responding to other therapies. [Conclusion Grade III: See Conclusion Grading Worksheet G - Annotation #13 (Inotropes) in the original guideline document] As palliative treatment in select patients, the available data supports continuous infusion over repetitive intermittent infusion.

Calcium Channel Blockers

- Diltiazem, nifedipine, and verapamil have been associated with adverse outcomes in patients with diminished LV function and should be avoided.
- Among the calcium antagonists, amlodipine seems less likely to worsen non-ischemic heart failure. The Prospective Randomized Amlodipine Survival Evaluation (PRAISE) study demonstrated no adverse effects on survival or cardiac morbidity when amlodipine was added to patients with Class II or III heart failure with EF less than 30% and in whom an ACE inhibitor, digoxin and diuretics were already being used.

Evidence supporting these recommendations is of class: A

Anti-arrhythmics

- The role of prophylactic antiarrhythmic drug therapy to prevent sudden cardiac death in patients with cardiomyopathy, HF, and asymptomatic ventricular ectopic activity (VPBs or NSVT) is probably not recommended. These drugs are less likely to suppress ventricular arrhythmias in patients with HF and may be associated with life threatening complications such as proarrhythmia, which is more likely in HF, and worsening of left ventricular function.
- Nearly all antiarrhythmic agents can exert clinically significant negative inotropic effects, which may limit the utility and safety of these drugs in patients with left ventricular dysfunction.
- Only amiodarone and dofetilide have been shown to be mortality neutral when treating arrhythmias in patients with heart failure.
- The recent publication of the results of the Sudden Cardiac Death in Heart Failure Trial (SCD-HeFT), demonstrated that in patients with NYHA Class II or Class III CHF and LVEF of 35 percent or less, amiodarone had no favorable effect on survival, despite the use of appropriate dosage and reasonable compliance rates over longer periods than in other placebo controlled trials. Whereas single-lead, shock-only instantaneous cardiac death (ICD) therapy reduces overall mortality and the relative risk of death by 23 percent, resulting in an absolute reduction of 7.2 percentage points at 5 years among patients with CHF who received state of the art background medical therapy, and the benefit did not vary according to the cause of CHF.

- In the Multicenter Automatic Defibrillator Implantation Trial 2 (MADIT 2), a study of patients who had had a myocardial infarction, and in the Antiarrhythmics Versus Implantable Defibrillators (AVID) study, a secondary prevention trial, the worse the ejection fraction, the greater the benefit of ICD therapy. In the Defibrillators in Non-Ischemic Cardiomyopathy Treatment Evaluation (DEFINITE) trial, patients in NYHA Class III derived the largest survival benefit from ICD therapy.

Evidence supporting this recommendation is of class: A

Anticoagulants

- Anticoagulation with warfarin is indicated in HF patients with atrial fibrillation mechanical heart valves, or in patients with impaired systolic function (i.e., ejection fraction [EF] less than 20%) and prior thromboemboli and left ventricular mural thrombi. No studies to date have shown a significant difference in major outcomes with patients taking warfarin.
- Emboli due to ventricular thrombi in patients with chronic congestive failure are uncommon and occur most frequently in patients with very low ejection fractions (less than 20%).
- Patients with atrial fibrillation and heart failure are at high risk for thromboemboli.

Refer to the NGC summary of the ICSI guideline Anticoagulant Therapy Supplement.

Evidence supporting these recommendations is of classes: A, B

14. Non-Pharmacologic Management

Key Points:

- Dietary indiscretion is the most common cause of exacerbation of heart failure.
- Sodium restriction alone may provide substantial benefits for heart failure patients. Dietary counseling is important for patients to learn the need for fluid balance management, avoiding excess sodium and/or water intake. Referral to a dietitian should be considered for patients with comorbid conditions or repeat episodes of edema.
- Daily weights are important for managing heart failure and early detection of increases in fluid retention. Patients should call their provider for a 2-pound or greater weight gain over night or a 5-pound or greater weight gain in a week.
- Simplifying medication regimes as much as possible should be explored. All medications, including over the counter (OTC) medications should be reviewed at each visit.
- Major depression is common in patients hospitalized with heart failure and is independently associated with a poor prognosis. Additionally, depression is independently associated with a substantial increase risk of heart failure in older patients with isolated systolic hypertension.

- Consider utilizing a heart failure clinic or case management for patients with medical problems or is at high risk for re-hospitalization.

Patient education for early symptom recognition and counseling about their disease process should be initiated at this time. See the Other Resources Available section in the original guideline document for websites and tools to assist the provider and patient with non-pharmacologic management of heart failure.

Refer to the original guideline documents for additional information on dietary recommendations, daily weights, medication regimens, exercise and activity guidelines, smoking cessation, coping with chronic diseases, advanced directives, and end-of-life considerations.

15. Symptom Control Satisfactory?
    - Consider reassessment of ventricular function (echocardiography or radionuclide ventriculography) if the symptoms persist despite changes in pharmacologic management or if symptoms markedly change.

16. Ongoing Assessment of Response to Treatment and Evaluation for Symptom Exacerbation
    - After initial evaluation and diagnosis, follow-up of HF patients in the ambulatory setting should focus on optimizing pharmacologic therapy and prevention of HF exacerbations.
    - Patient education should be ongoing and consistently reinforced, and family members should be a part of this process whenever possible. Symptoms of worsening heart failure should be explained, and patients should be advised to contact their provider or nurse if these symptoms develop.
    - Patients should be advised to call their provider for a greater or equal 2 lbs/day weight gain or 5+ lbs/week.
    - Also refer to Appendix A in the original guideline document, "Strategies to Address Adherence to Treatment Plan."

Accessibility

Intimidation by or frustration with large health care systems and social isolation are factors that distance patients from their health care providers. A patient's failure to maintain this contact, as well as inadequate patient education, contribute to poor patient compliance and high hospital admission and readmission rates in this population.

- To prevent HF exacerbation, efforts and resources should be directed toward early intervention in the form of increased accessibility to care and education aimed at symptom recognition and treatment plan adherence.
- Frequently, patients wait until they are in crisis before seeking medical assistance, bypassing the provider's office and going straight to the Emergency Department (ED). Limited hours and limited/untrained staff at providers' offices have been cited as reasons patients seek acute care with worsening symptoms of heart failure.

- Case managers and HF clinics may be effective strategies to avert Emergency Department visits and hospitalizations by providing patients with a contact person who is familiar with their care to expedite treatment alternatives. This contact person, usually a nurse, is available to answer questions and clarify instructions, potentially increasing treatment plan compliance. The nurse should have adequate ancillary support services available (e.g., social workers, dietary, etc.).
- Time between visits is important for the patient to formulate questions and assimilate the previously presented information. Family members and care givers should also be involved in education to support the patient's efforts.

Evidence supporting these recommendations is of classes: A, R

## Emergent Management Algorithm Annotations

17. Initial Patient Assessment
    - History
    - Physical

    Notes:

    - Patients with decompensated aortic stenosis should not receive vasodilator agents (vs. mitral regurgitation patients that benefit greatly).
    - Patients with jugular venous distension from right ventricular infarct may require a fluid challenge.
    - Patients with low cardiac output and peripheral vasoconstriction have unreliable noninvasive blood pressure measures.
    - Digoxin, as an inotrope, is not useful in the acute management of decompensated heart failure (may be used to control atrial fibrillation).

    Differential Diagnosis:

    - Chronic obstructive lung disease
    - Asthma exacerbation
    - Volume overload (iatrogenic)
    - Chordae rupture
    - Acute coronary syndrome
    - Pulmonary embolism
    - Sepsis
    - Severe pneumonia
    - Anaphylaxis

20. Initiate $O_2$ Therapy, Start IV, Order Labs, Chest X-Ray and Electrocardiogram (ECG). Consider Echocardiogram (ECHO)
    A. Initial Laboratory Assessment:
        - Complete blood count (CBC)
        - Electrolytes ($Na^+$, $K^+$)
        - Renal function (blood urea nitrogen, creatinine)
        - Magnesium (if on diuretics)

- Calcium
- Urinalysis
- Digoxin level (if on digoxin)
- Prothrombin time/international normalized ratio (PT/INR) if on coumadin
- Cardiac markers (creatine kinase muscle band [CKMB], troponin)
- Glucose
- BNP (if the diagnosis is uncertain)
- Blood gases (may be indicated if the patient is hypoxic, has underlying lung disease, or has persistent respiratory distress).

B. ECG and continuous rhythm monitoring: Recommended in all cases.
C. Imaging: A chest x-ray is recommended in all cases.
    - An emergent echocardiogram is indicated for the patient who is not improving with initial interventions.

22. Adjust $O_2$ Delivery/Consider Continuous Positive Airway Pressure (CPAP)/Bilevel PAP (BiPAP)/Intubation

Non-invasive ventilatory support has been proven effective and may reduce the need for intubation. Continuous positive airway pressures (CPAP) and bilevel positive airway pressure are both effective airway support. Bilevel use is controversial in patients with acute MI.

Acute Pulmonary Edema Algorithm

39. Volume Overload?

Patients with persistent volume overload may be candidates for continuous intravenous (IV) diuretics, ultrafiltration, or hemodialysis (all out of guideline).

40. Loop Diuretic: IV Bolus, Consider IV Infusion
    - Furosemide is the most commonly used loop diuretic, with the dose adjusted upward if the patient is currently on oral doses. Diuretic effect occurs in 30 minutes with peak effect in 1 to 2 hours.
    - Torsemide or Bumetanide (Bumex) IV is an alternative loop diuretic.

The pharmacologic characteristics of all loop diuretics are similar. Therefore, a lack of response to adequate doses of one loop diuretic mitigates against the administration of another loop diuretic; instead, combinations of diuretics with different mechanisms of action should be given.

In patients who have poor responses to intermittent doses of a loop diuretic, a continuous intravenous infusion can be tried. If an effective amount of the diuretic is maintained at the site of action at all times, a small but clinically important increase in the response may occur. There are other reasons to consider giving a continuous infusion of a loop diuretic. It may be easier for nursing staff to give a continuous infusion than intermittent bolus intravenous

doses. In addition, with a continuous infusion, decisions about the timing of doses of an additional diuretic are simplified. Finally, by closely monitoring urinary output, one can unambiguously determine whether the added drug was beneficial.

Another strategy to enhance the response to a loop diuretic is to add an oral or IV thiazide diuretic. Metolazone is frequently given in the United States, whereas other thiazides are given elsewhere. The pharmacologic characteristics of metolazone are similar to those of other thiazides. Some formulations of the drug are absorbed poorly and slowly, and it has a long elimination half-life (about two days). Thus, metolazone accumulates over a period of about 10 days. Other thiazides have the same synergistic effects when combined with a loop diuretic. Since the absorption of other thiazides, such as hydrochlorothiazide, is more rapid and predictable, they may be preferable to metolazone.

Evidence supporting this recommendation is of classes: A, D, R

41. Nitroglycerin sublingual (SL) or Drip

Concurrent with diuretic therapy is the initiation of vasodilators

- Nitroglycerin, 0.4 mg sublingual or paste.

Many patients will improve symptomatically with the "first-line therapy" and may be transferred to an observation unit or inpatient bed.

Patients who are not improving will need more aggressive treatment.

- Begin nitroglycerin infusion at 10 to 20 micrograms/minute (min) and increase by 10 to 20 micrograms/min every 3 to 5 minutes to achieve desired effect. The maximum dose is 300 micrograms/min.
- This work group recommends the upward titration of nitroglycerin before converting to nesiritide.

Alternative dosing protocols exist which may provide a greater safety margin, such as:

IV: non-PVC tubing, 5 micrograms/min, initial titration should be in 5 micrograms/min increments at intervals of 3 to 5 min guided by patient response; if no response is seen at 20 micrograms/min, incremental increases of 10 and 20 micrograms/min may be used; PVC tubing, initial dose 25 micrograms/min IV

Additional note: some intensive care units (ICUs) and Emergency Departments (EDs) are now titrating in micrograms/kilogram (kg)/min.

Patients who continue to exhibit signs and symptoms of volume overload despite aggressive loop diuretics and IV nitroglycerin may be a candidate for nesiritide.

Nesiritide reduces pulmonary capillary wedge pressure and improves dyspnea in patients with acute decompensated heart failure. Compared with dobutamine, ventricular arrhythmias and cardiac arrest occurred less frequently with nesiritide. Nesiritide can cause symptomatic hypotension comparable to nitroglycerin; however, the duration of symptomatic hypotension with nesiritide is longer (2.2 hours versus 0.7 hours).

- Nesiritide 2 micrograms IV bolus, then 0.01 micrograms/kg/min IV infusion.
- Nesiritide, a natriuretic peptide, has been tested in combination with diuretics but not with IV nitroglycerin. The safety profile is favorable in comparison with the phosphodiesterase inhibitors (e.g., milrinone) or the adrenergic inotropes (e.g., dobutamine).

The experience with nesiritide to date has been limited, in comparison with the other two drugs.

Evidence supporting this recommendation is of classes: A, R

43. Stabilized?

Patients who stabilize may be admitted to an observation unit or monitored hospital bed.

Unstable criteria include:

- Unstable vital signs
- ECG or serum markers of myocardial ischemia
- Decompensation (concomitant end-organ hypoperfusion, volume overload, and systemic vasoconstriction)
- Requiring continuous vasoactive medication (e.g., nitroglycerin, nitroprusside, dobutamine, or milrinone) to stabilize hemodynamics
- Nonsustained ventricular tachycardia not caused by electrolyte imbalance
- Acute mental status abnormality
- Severe electrolyte imbalances

45. Emergency Department (ED) Observation or Short Stay Candidate?

Some heart failure patients may be managed in a short stay or observation unit. A short stay for diagnosis, intensive therapy, and education has demonstrated advantages. Institutions which utilize observation units will need to have selection criteria and observation protocols to achieve optimal results.

Peacock and Albert provide a framework for the use of observation units in the management of heart failure patients. Observation units provide a cost-effective alternative to hospitalization for select patients.

Evidence supporting this recommendation is of class: R

Definitions:

Conclusion Grades:

Grade I: The evidence consists of results from studies of strong design for answering the question addressed. The results are both clinically important and consistent with minor exceptions at most. The results are free of any significant doubts about generalizability, bias, and flaws in research design. Studies with negative results have sufficiently large samples to have adequate statistical power.

Grade II: The evidence consists of results from studies of strong design for answering the question addressed, but there is some uncertainty attached to the conclusion because of inconsistencies among the results from the studies or because of minor doubts about generalizability, bias, research design flaws, or adequacy of sample size. Alternatively, the evidence consists solely of results from weaker designs for the question addressed, but the results have been confirmed in separate studies and are consistent with minor exceptions at most.

Grade III: The evidence consists of results from studies of strong design for answering the question addressed, but there is substantial uncertainty attached to the conclusion because of inconsistencies among the results of different studies or because of serious doubts about generalizability, bias, research design flaws, or adequacy of sample size. Alternatively, the evidence consists solely of results from a limited number of studies of weak design for answering the question addressed.

Grade Not Assignable: There is no evidence available that directly supports or refutes the conclusion.

Classes of Research Reports:

A. Primary Reports of New Data Collection:

Class A:

- Randomized, controlled trial

Class B:

- Cohort study

Class C:

- Non-randomized trial with concurrent or historical controls
- Case-control study
- Study of sensitivity and specificity of a diagnostic test
- Population-based descriptive study

Class D:

- Cross-sectional study
- Case series
- Case report

B. Reports that Synthesize or Reflect upon Collections of Primary Reports:

Class M:

- Meta-analysis
- Systematic review
- Decision analysis
- Cost-effectiveness analysis

Class R:

- Consensus statement
- Consensus report
- Narrative review

Class X:

- Medical opinion

### CLINICAL ALGORITHM(S)

Detailed and annotated clinical algorithms are provided for:

- Heart Failure in Adults
- Emergent Management
- Acute Pulmonary Edema

## EVIDENCE SUPPORTING THE RECOMMENDATIONS

### TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is classified for selected recommendations (see "Major Recommendations").

In addition, key conclusions contained in the Work Group's algorithm are supported by a grading worksheet that summarizes the important studies pertaining to the conclusion. The type and quality of the evidence supporting these key recommendations (i.e., choice among alternative therapeutic approaches) is graded for each study.

## BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

### POTENTIAL BENEFITS

- Accurate diagnosis of heart failure (HF) through improved use of diagnostic testing

- Appropriate treatment and management of HF that may prevent disease progression, maintain or improve quality of life, decrease re-admission rate within 30 days of discharge, and increase survival

### POTENTIAL HARMS

Adverse events associated with medications

## CONTRAINDICATIONS

### CONTRAINDICATIONS

- Contraindications to angiotensin-converting enzyme (ACE) inhibitors include history of intolerance or adverse reactions to these agents, serum potassium >5.5 mEq/L, symptomatic hypotension (unless due to excessive diuresis), severe renal artery stenosis, pregnancy, cough and rash side effects.
- Contraindications to angiotensin receptor blockers (ARBs) include history of intolerance or adverse reactions to these agents, serum potassium greater than 5.5 meq/L, symptomatic hypotension (unless due to excessive diuresis), severe renal artery stenosis, and pregnancy.

## QUALIFYING STATEMENTS

### QUALIFYING STATEMENTS

- This health care guideline is designed to assist clinicians by providing an analytical framework for the evaluation and treatment of patients, and is not intended either to replace a clinician's judgment or to establish a protocol for all patients with a particular condition. A guideline will rarely establish the only approach to a problem.
- This health care guideline should not be construed as medical advice or medical opinion related to any specific facts or circumstances. Patients are urged to consult a health care professional regarding their own situation and any specific medical questions they may have.
- The acute pulmonary edema (APE) guideline surfaces areas of weak or absent evidence for some traditional therapies. Per Felker et al., "the syndrome of decompensated heart failure remains poorly defined and vastly understudied. Few high-quality epidemiologic studies, randomized controlled trials, or published guidelines are available to guide the management of this complex disease. In addition, there is no consensus definition of the clinical problem that it presents, no agreed upon nomenclature to describe its clinical features, and no recognized classification scheme for its patient population; all of which has contributed to the lack of therapeutic development in this critical arena of cardiovascular disease."

## IMPLEMENTATION OF THE GUIDELINE

### DESCRIPTION OF IMPLEMENTATION STRATEGY

Once a guideline is approved for general implementation, a medical group can choose to concentrate on the implementation of that guideline. When four or more groups choose the same guideline to implement and they wish to collaborate with others, they may form an action group.

In the action group, each medical group sets specific goals they plan to achieve in improving patient care based on the particular guideline(s). Each medical group shares its experiences and supporting measurement results within the action group. This sharing facilitates a collaborative learning environment. Action group learnings are also documented and shared with interested medical groups within the collaborative.

Currently, action groups may focus on one guideline or a set of guidelines such as hypertension, lipid treatment, and tobacco cessation.

Detailed measurement strategies are presented in the original guideline document to help close the gap between clinical practice and the guideline recommendations. Summaries of the measures are provided in the National Quality Measures Clearinghouse (NQMC).

### Key Implementation Recommendations

The following system changes were identified by the guideline work group as key strategies for health care systems to incorporate in support of the implementation of this guideline.

1. Establish processes that will allow primary care to identify patients who have been re-admitted to the hospital for heart failure.
2. Emphasize patient activation strategies. These may include heart failure education and other actions designed to sustain engagement of patients with their heart failure care. Patients should be educated in the area of diet, weight monitoring, activity level, importance of discharge instructions if hospitalized, medications, the importance of follow-up appointments, and what to do if symptoms worsen.
3. Establish process to educate patient caregiver(s). The caregiver should be educated in the area of diet, weight monitoring, activity level, importance of discharge instructions if hospitalized, medications (what they are, dosage and what they do), the importance of follow-up appointments and what to do if symptoms worsen.

## IMPLEMENTATION TOOLS

Chart Documentation/Checklists/Forms
Clinical Algorithm
Patient Resources
Pocket Guide/Reference Cards
Quality Measures

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

## RELATED NQMC MEASURES

- Heart failure in adults: percentage of adult patients with a primary diagnosis of heart failure who are re-admitted for heart failure within 30 days of discharge.
- Heart failure in adults: percentage of adult patients with a primary diagnosis of heart failure who have left ventricular systolic dysfunction (LVSD) and who do not have contraindications to taking both angiotensin-converting enzyme inhibitors (ACEI) and angiotensin receptor blockers (ARBs), who are prescribed an ACEI or an ARB at hospital discharge.
- Heart failure in adults: percentage of adult patients with a primary diagnosis of heart failure who have left ventricular systolic dysfunction (LVSD) and who do not have a contraindication to taking beta-blockers, who are prescribed beta-blocker therapy at hospital discharge.
- Heart failure in adults: percentage of adult patients with a primary diagnosis of heart failure with documentation in the hospital record that left ventricular function (LVF) was assessed before arrival, during hospitalization, or is planned for after discharge.
- Heart failure in adults: percentage of adult patients with a primary diagnosis of heart failure discharged home with written instructions or educational material given to the patient or his or her caregiver at discharge or during the hospital stay, addressing all of the following: activity level, diet, discharge medications, follow-up appointment, weight monitoring, and what to do if symptoms worsen.
- Heart failure in adults: percentage of adult patients with a primary diagnosis of heart failure who are current smokers who are given smoking cessation advice or counseling during the hospital stay or at discharge.
- Heart failure in adults: percentage of adult heart failure patients who have ever had left ventricular systolic dysfunction (LVSD) and met the following (for which they are eligible) at their last clinic visit: prescribed or were taking angiotensin-converting enzyme inhibitor/angiotensin receptor blockers (ACEI/ARB), prescribed or were on beta blocker therapy, non-smoker (primary care and outpatient cardiology).
- Heart failure in adults: percentage of adult heart failure patients with documentation that left ventricular function (LVF) was assessed or will be assessed (primary care and outpatient cardiology).
- Heart failure in adults: percentage of adult heart failure patients to whom (or to their caregivers) written or verbal instructions or educational material are given during the clinic visit, addressing one or more of the following: activity level, diet, medications, follow-up appointment, weight monitoring, and what to do if symptoms worsen (primary care and outpatient cardiology).
- Heart failure in adults: percentage of adult heart failure patients who are current smokers who were given smoking cessation advice or counseling at the last clinic visit (primary care and outpatient cardiology).
- Heart failure in adults: percentage of adult heart failure patients who are non-smokers (primary care and outpatient cardiology).

## INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better
Living with Illness

## IOM DOMAIN

Effectiveness
Patient-centeredness
Timeliness

# IDENTIFYING INFORMATION AND AVAILABILITY

## BIBLIOGRAPHIC SOURCE(S)

Institute for Clinical Systems Improvement (ICSI). Heart failure in adults. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2006 Aug. 116 p. [204 references]

## ADAPTATION

This guideline follows closely the Agency for Health Care Policy and Research's (AHCPR), now known as the Agency for Healthcare Research and Quality, (AHRQ) Heart Failure Guideline. The only significant deviation is the guideline developer's recommended assessment of left ventricular (LV) function earlier.

## DATE RELEASED

1997 Oct (revised 2006 Aug)

## GUIDELINE DEVELOPER(S)

Institute for Clinical Systems Improvement - Private Nonprofit Organization

## GUIDELINE DEVELOPER COMMENT

Organizations participating in the Institute for Clinical Systems Improvement (ICSI): Affiliated Community Medical Centers, Allina Medical Clinic, Altru Health System, Aspen Medical Group, Avera Health, CentraCare, Columbia Park Medical Group, Community-University Health Care Center, Dakota Clinic, ENT Specialty Care, Fairview Health Services, Family HealthServices Minnesota, Family Practice Medical Center, Gateway Family Health Clinic, Gillette Children's Specialty Healthcare, Grand Itasca Clinic and Hospital, HealthEast Care System, HealthPartners Central Minnesota Clinics, HealthPartners Medical Group and Clinics, Hutchinson Area Health Care, Hutchinson Medical Center, Lakeview Clinic, Mayo Clinic, Mercy Hospital and Health Care Center, MeritCare, Mille Lacs Health System, Minnesota Gastroenterology, Montevideo Clinic, North Clinic, North Memorial Care System, North Suburban Family Physicians, Northwest Family Physicians, Olmsted Medical Center, Park Nicollet Health Services, Pilot City Health Center, Quello Clinic, Ridgeview Medical Center, River Falls Medical Clinic, Saint Mary's/Duluth Clinic Health System, St. Paul Heart Clinic, Sioux Valley Hospitals and Health System, Southside Community Health Services, Stillwater Medical Group, SuperiorHealth Medical Group, University of Minnesota Physicians, Winona Clinic, Ltd., Winona Health

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## GUIDELINE COMMITTEE

Cardiovascular Steering Committee (CVSC)

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## FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

In the interest of full disclosure, Institute for Clinical Systems Improvement (ICSI) has adopted the policy of revealing relationships work group members have with companies that sell products or services that are relevant to this guideline topic. The reader should not assume that these financial interests will have an adverse impact on the content of the guideline, but they are noted here to fully inform readers. Readers of the guideline may assume that only work group members listed below have potential conflict of interest to disclose.

Robert Straka, PharmD received grant support from Abbott Labs and honoraria from Pfizer, Astra Zeneca, and Merck-Schering Plough.

Steve Kopecky, MD receives grant support from Endomatrix, AtheroGenics, and Bristol-Myers Squib; is a consultant for Paringenix and Glaxo SmithKline; and is on the medical advisory board for BioPhysical Corp.

Joshua Breeding, PharmD, BCPS is a consultant for Aventis and Scios.

No other work group members have potential conflicts of interest to disclose.

ICSI's conflict of interest policy and procedures are available for review on ICSI's website at www.icsi.org.

## GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Heart failure in adults. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI); 2005 Jun. 111 p.

## GUIDELINE AVAILABILITY

Electronic copies: Available from the Institute for Clinical Systems Improvement (ICSI) Web site.

Print copies: Available from ICSI, 8009 34th Avenue South, Suite 1200, Bloomington, MN 55425; telephone, (952) 814-7060; fax, (952) 858-9675; Web site: www.icsi.org; e-mail: icsi.info@icsi.org.

## AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- Heart failure in adults. Executive summary. Bloomington (MN): Institute for Clinical Systems Improvement, 2006 Aug. 1 p. Electronic copies: Available from the Institute for Clinical Systems Improvement (ICSI) Web site.
- Order sets: Heart Failure. Bloomington (MN): Institute for Clinical Systems Improvement, 2006. Electronic copies: Available from the Institute for Clinical Systems Improvement (ICSI) Web site.
- Measurement tool –optional medical record review format for ACE inhibitor use. Available from the original guideline document.
- ICSI pocket guidelines. April 2006 edition. Bloomington (MN): Institute for Clinical Systems Improvement, 2006. 298 p.

Print copies: Available from ICSI, 8009 34th Avenue South, Suite 1200, Bloomington, MN 55425; telephone, (952) 814-7060; fax, (952) 858-9675; Web site: www.icsi.org; e-mail: icsi.info@icsi.org.

## PATIENT RESOURCES

The following is available:

- Heart failure in adults. Bloomington (MN): Institute for Clinical Systems Improvement, 2006 Oct.

Electronic copies: Available in Portable Document Format (PDF) from the Institute for Clinical Systems Improvement (ICSI) Web site.

Please note: This patient information is intended to provide health professionals with information to share with their patients to help them better understand their health and their diagnosed disorders. By providing access to this patient information, it is not the intention of NGC to provide specific medical

advice for particular patients. Rather we urge patients and their representatives to review this material and then to consult with a licensed health professional for evaluation of treatment options suitable for them as well as for diagnosis and answers to their personal medical questions. This patient information has been derived and prepared from a guideline for health care professionals included on NGC by the authors or publishers of that original guideline. The patient information is not reviewed by NGC to establish whether or not it accurately reflects the original guideline's content.

### NGC STATUS

This NGC summary was completed by ECRI on October 9, 2002. The information was verified by the guideline developer on October 21, 2002. This summary was updated by ECRI on April 1, 2004, July 27, 2004, September 16, 2005, and October 5, 2006. This summary was updated by ECRI on March 6, 2007 following the U.S. Food and Drug Administration (FDA) advisory on Coumadin (warfarin sodium). This summary was updated by ECRI Institute on July 12, 2007 following the U.S. Food and Drug Administration (FDA) advisory on Troponin-1 Immunoassay. This summary was updated by ECRI Institute on September 7, 2007 following the revised U.S. Food and Drug Administration (FDA) advisory on Coumadin (warfarin).

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